

The present invention is directed to a thermal transfer roller having an outer cylindrical shell which contacts a substrate being heated or cooled, and an inner cylindrical shell which is coaxially positioned within the outer shell to define a continuous annulus between the inner cylindrical shell and the outer cylindrical shell through which heat transfer fluid may flow. A “continuous” annulus refers to an annulus having an uninterrupted or non-partitioned area in a circumferential direction, as shown in Fig. 1.

As shown in Figs. 1 and 2, the thermal transfer roller also includes a roll journal on one or both ends of the thermal transfer roller with a hollow passage extending along a central axis of the thermal transfer roller between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller. The passage transfers heat transfer fluid from the outlet end to the inlet end and is in fluidic communication with the annulus.

In one embodiment of this invention, the annulus includes a plurality of individual channels as shown in Fig. 3, separated by spiral walls, which carry heat transfer fluid through the annulus from an inlet end of the thermal transfer roller to an outlet end of the thermal transfer roller. In this embodiment, the heat transfer fluid circulates around the annulus in a spiral flow pattern via the channels as the thermal transfer roller rotates, providing a substantially even fluid supply and distribution through the annulus.

Amendment to the Drawings

Applicants have amended Fig. 2 to consistently correspond to the specification as amended. The second occurrence of element reference number "20" was deleted and new element reference number "21" was added to reference the first (inlet) end.

Amendment to the Specification

Applicants have amended the specification to consistently name the elements of Applicants' claimed invention, namely the passage 24, the inlet channel 26, and the roll journals 32 and 42. This amendment is fully supported in the specification at page 4, lines 15-19, wherein it is stated:

The heat transfer roller includes a roll journal on one or both ends provided with a passage for injecting and/or removing heat transfer fluid to and from the roller. A disk-shaped chamber is provided on one or both ends of the heat transfer roller for carrying heat transfer fluid between the corresponding roller journal and the annulus.

Applicants believe that the above Amendment adds no new matter to this Patent Application. It is readily apparent to one having ordinary skill in the art that the roll journal disclosed at Page 4, line 14 refers to element reference numbers 32 and 42 in Fig. 2 and that the passage disclosed at Page 4, line 16 refers to element reference number 24 in Figs. 1 and 2.

Amendment to the Claims

Applicants have amended independent Claims 1 and 14 to require that the inner shell be coaxially positioned within the outer shell to define a continuous annulus between an inner surface of the outer shell and an outer surface of the inner shell. Independent Claim 20 has been similarly amended to recite that the continuous annulus is defined by an inner surface of an outer cylindrical shell and an outer surface of an inner cylindrical shell. This amendment is fully supported in the specification at page 10, lines 3-7, at page 15, lines 15-19, and in Figs. 1 and 2.

Further, Applicants have amended independent Claims 1, 14 and 20 to require a passage in communication with the annulus and extending between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller. The passage initially transfers fluid from the outlet end to the inlet end. This amendment is fully supported in the specification at page 4, lines 15-19, at page 10, lines 12-16 and in Fig. 2.

Claim Objections - 37 C.F.R. 1.75

Claims 23 and 25 have been objected to under 37 C.F.R. 1.75 as being a substantial duplicate of Claims 22 and 24 respectively. Applicants respectfully transverse this objection. Dependent Claim 22 requires one thermal transfer roller of Claim 20 and a second transfer roller. The second transfer roller does not necessarily have to be a thermal transfer roller of Claim 20. Conversely, Claim 23 requires two

thermal transfer rollers of Claim 20, thus requiring two identical thermal transfer rollers. Thus, Applicants urge that Claim 23 is not a substantial duplicate of Claim 22. Nor are Claims 22 and 23 otherwise so close in content as to cover the same thing

Similarly, dependent Claim 24 requires one thermal transfer roller of Claim 21 and a second transfer roller. The second transfer roller does not necessarily have to be a thermal transfer roller of Claim 21. Conversely, Claim 25 requires two thermal transfer rollers of Claim 21, thus requiring two identical thermal transfer rollers. Thus, Applicants urge that Claim 25 is not a substantial duplicate of Claim 24. Nor are Claims 24 and 25 otherwise so close in content as to cover the same thing. Therefore, Applicants respectfully request withdrawal of this objection.

Claim Rejections - 35 U.S.C. §102

The rejection of Claims 1-4, 8, 9, 14 and 18-21 under 35 U.S.C. §102(b) as being anticipated by Seanor, U.S. Patent 2,783,977 (Seanor), is respectfully traversed, particularly in view of the above Amendment and the following remarks. Applicants' invention as claimed in amended independent Claims 1, 14 and 20 requires a continuous annulus defined by an inner surface of an outer shell and an outer surface of an inner shell. Further, Claims 1 and 14 require that the inner shell be coaxially positioned within the outer shell to define the continuous annulus. Thus, Applicants' invention requires both an outer shell 12 and an inner shell 14 which define the continuous annulus 16. As shown in Fig. 1, the annulus 16 is continuous

about a periphery of the thermal transfer roller 10 between the inner surface of the outer shell 12 and the outer surface of the inner shell 14.

Additionally, the thermal transfer roller as claimed in amended independent Claims 1, 14 and 20 requires a passage in communication with the annulus and extending between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller. As shown in Fig. 2 and discussed in the specification at page 4, lines 15-19 and at page 10, lines 12-16, the passage 24 transfers fluid through the center of the thermal transfer roller 10 from the outlet end 22 to the inlet end 21. These novel claim limitations are disclosed throughout Applicants' specification, but are not taught or suggested in Seanor.

The heat exchanger of Seanor comprises "a fabricated metal roll or drum 2 which has a plurality of longitudinally directed, circumferentially spaced holes 3 extending the length thereof. The roll 2 has a bore 4 therein and it has counterbored ends 5 that connect to the holes 3 at the ends thereof." See Seanor at Col. 2, lines 54 through 59. Thus, the heat exchanger of Seanor comprises one drum 2 having holes 3 which align with the bores formed in the counterbored ends 5. The longitudinally directed holes 3 are best shown in Fig. 4 of Seanor. **At the lower right-hand corner of Fig. 4, a partial cross-sectional view of the drum 2 clearly shows the longitudinally directed holes 3.** Seanor does not disclose an outer shell and a coaxially positioned inner shell which form or define a continuous annulus

therebetween, as required by Applicants' claimed invention. Seanor discloses a heat exchanger wherein the heat exchange fluid flows through discrete holes, such as holes 3a and 3b, which are circumferentially spaced about the inner end plate 9. Thus, the heat exchange fluid is not evenly distributed about the periphery of the drum and cannot provide uniform heat transfer.

Further, unlike Applicants' claimed invention, Seanor does not disclose a passage which extends along a central axis of the heat exchanger to transfer heat transfer fluid from one end of the heat exchanger to the opposite end of the heat exchanger.

Applicants urge that the above Amendment and remarks overcome the rejection of Claims 1-4, 8, 9, 14 and 18-21 under 35 U.S.C. §102(b) as being anticipated by Seanor. Thus, Applicants respectfully request withdrawal of this rejection.

Claim Rejections - 35 U.S.C. §103

The rejection of Claims 5-7, 10-12, 15-17 and 22-25 under 35 U.S.C. §103 as being unpatentable over Seanor is respectfully traversed, particularly in view of the above Amendment and the following remarks.

Claims 5-7 and 10-12 ultimately depend from and further limit independent Claim 1, which Applicants believe is patentable for the reasons presented

above. Claims 15-17 ultimately depend from and further limit independent Claim 14, which Applicants believe is patentable for the reasons presented above.

Claims 5-7, 10-12 and 15-17 recite 10, 20 and 30 channels in the embodiment of the respective independent Claim from which they depend. As set forth above, contrary to the Examiner's assertion, Seanor does not teach or suggest important claimed features of the present invention regardless of the claimed number of channels.

Claims 22-25 ultimately depend from and further limit independent Claim 20, which Applicants believe is patentable for the reasons presented above. Seanor does not teach or suggest important claimed features of the present invention as claimed in amended Claim 20 regardless of the number of rollers claimed in Claims 22, 23, 24 and 25.

Applicants urge that the above Amendment and remarks overcome the rejection of Claims 5-7, 10-12, 15-17 and 22-25 under 35 U.S.C. §103 as being unpatentable over Seanor. Thus, Applicants respectfully request withdrawal of this rejection.

The rejection of Claim 13 under 35 U.S.C. §103 as being unpatentable over Seanor in view of Eriksen et al., U.S. Patent 5,590,704, is respectfully traversed, particularly in view of the above Amendments and the following remarks.

Claim 13 depends from and further limits Claim 1, which Applicants believe is patentable for the reasons presented above. It would not have been obvious at the time this invention was made to a person having ordinary skill in the art to employ in Seanor a spiral fluid flow channel for the purpose of reducing flow resistance as disclosed in Eriksen et al.

Applicants urge that the above remarks overcome the rejection of Claim 13 under 35 U.S.C. §103 as being unpatentable over Seanor in view of Eriksen et al. Thus, Applicants respectfully request withdrawal of this rejection.

CONCLUSION

Applicants intend to be fully responsive to the outstanding Office Action. If the Primary Examiner detects any issue which the Primary Examiner believes Applicants have not addressed in this response, Applicants urge the Primary Examiner to contact the undersigned.

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Applicants sincerely believe that this patent application is now in condition for allowance and, thus, respectfully request early allowance.

Respectfully submitted,



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